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BALANCED FLUID TREATMENT APPARATUS

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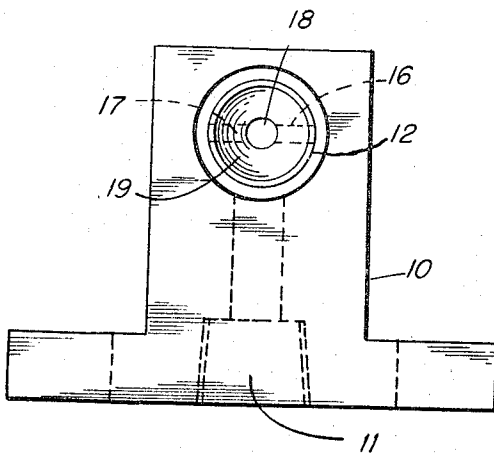


FIGURE 1

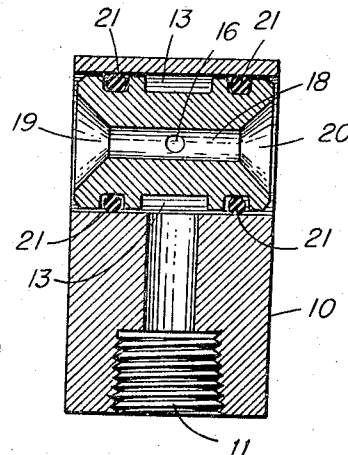


FIGURE 2

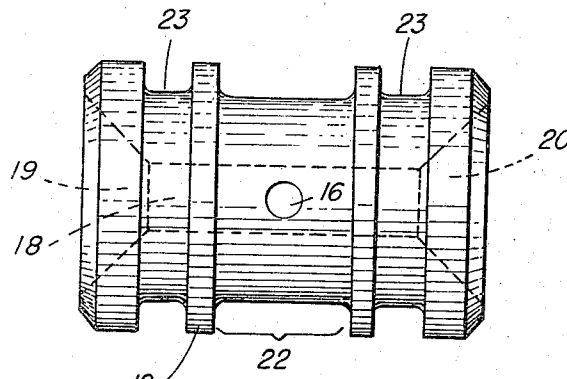


FIGURE 3

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BALANCED FLUID TREATMENT APPARATUS
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6 Claims. (Cl. 28—1)

This invention relates to a balanced fluid treatment apparatus and more particularly to an apparatus utilizing a fluid for intermingling filaments or groups of filaments of multifilament yarns especially mechanically crimped bulked multifilament yarns to produce a cohesive yarn product.

Yarn producers have long sought a method of avoiding twisting multifilament yarns which is required for adequate handling in the common textile operations such as weaving, knitting, tufting carpet yarns and the like. In the production of mechanically crimped bulked yarns especially for carpet manufacture, twisting the yarn provides the necessary cohesiveness but reduces considerably the bulk which is desired. Successful attempts have been made in avoiding twisting the yarns by passing these yarns through various fluid or air jet devices to provide compact cohesive yarns as well as loopy bulked yarn produced from as spun or zero twist non-bulked multifilament yarn. The loopy yarns are not considered desirable in carpet production since the loops cause great difficulty in processing through a carpet yarn tufting machine.

Although the apparatus of this invention can be utilized in compacting or loopy bulking of as-spun or zero twist yarn under certain conditions, the unique construction of this apparatus permits the intermingling of crimped filaments by means of a uniform balanced flow of fluid or air to provide a cohesive bulked yarn which has sufficient cohesiveness to pass the yarn through a carpet tufting machine without twisting and at the same time enhances the bulk of the yarn by deregistering the bundle crimp so that the corresponding crimp of the individual filaments are out of phase with one another. The fluid treatment apparatus of this invention embodies a housing with an opening preferably an annular opening, and means to supply the fluid to the opening. Plenum and an insert which fits into the opening is machined to close tolerances to provide a uniform, self balancing flow of fluid or air onto the yarn to be treated. The insert contains inlet and outlet ducts at its extremities for the passage of yarn and a connecting means between the inlet and outlet ducts forming in the interior of the connecting means a passageway for the yarn. The exterior of the connecting means contains a circumferential groove which, when the insert is placed in the opening of the housing, forms a desired plenum. From circumferential groove of the insert, there is at least one pair of diametrically opposed fluid conduits which are perpendicular to the axis of the inlet and outlet ducts and of sufficient length to run from the circumferential groove to the passageway in the connecting means. The plenum which is formed by the circumferential groove in the connecting means in combination with the housing provides a space wherein the pressure of the fluid is equalized and provides a uniform balance flow prior to the entrance of the fluid to the fluid conduits onto the yarn. Under these conditions, a higher degree of entanglement of the filaments of the yarn is obtained due to the symmetrical nature of the fluid flow on the yarn.

The invention will be more easily understood by reference to the drawings.

FIGURE 1 is a front elevation of the preferred fluid treatment apparatus.

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FIGURE 2 is a cross section along the lines A—A of FIGURE 1.

FIGURE 3 shows a side elevation of the insert of the preferred fluid treatment apparatus.

FIGURES 1 and 2 depict a preferred fluid treatment apparatus wherein the housing 10 contains an inlet 11 for the fluid to enter the plenum 13 as shown in FIGURE 2. The fluid moves within the plenum 13 until the plenum is filled and then moves through the diametrically opposed fluid conduits 16 and 17 to impinge the yarn running through passageway 18 through the concavely conically tapered inlet duct 19 and out the concavely conically tapered outlet duct 20. The insert 12 is maintained firmly in the housing by means of flexible O rings 21 while the apparatus is in use. It should be noted, however, that means such as threads could be incorporated in the housing and insert so that the insert could be screwed into place.

FIGURE 3 depicts a side elevation of the insert 12 containing circumferential groove 22, and ring receiving grooves 23 for placement of flexible O rings 21 as shown in FIGURE 2. The yarn passageway 18 connects the concavely conically tapered inlet duct 19 and concavely conical tapered outlet duct 20. The purpose of the tapered inlet and outlet ducts is to prevent the yarn from snagging on its passage through the air jet. In the circumferential groove 22, the diametrically opposed fluid conduits (one shown) 16 are of sufficient length to run from the surface of the circumferential groove 22 to the yarn passageway 16. The shape of the yarn passageway can be round, square, rectangular, pentagonal and the like depending on the needs. It is generally preferred however, to use a round shaped yarn passageway. The dimensions of the yarn passageway and fluid conduits can be varied as needed by interchanging inserts of appropriate sizes when the yarn sizes are changed. The interchange of inserts provides for great flexibility in dealing with varying sizes of yarn over those fluid treating devices which consist of fixed dimensions without the insert capability. A further advantage of the apparatus of this invention relates to the low manufacturing cost because of the ease of machining the insert to close tolerances while making the housing to wider tolerances.

The shape of the opening in the housing and the corresponding outer shape of the insert to be fitted into the opening is not necessarily critical. These shapes can be annular, square, rectangular, pentagonal etc. It is preferred however, to utilize an annular shape in view of the ease of manufacture of the housing opening and insert.

The term "fluid" as used herein relates to any inert material such as liquids or gases capable of separating filaments of yarn passing through the yarn passageway for purposes of intermingling the filaments. Fluids which can be used include water or other inert liquids but inert gaseous material such as steam, nitrogen, carbon dioxide, air etc. can be used. The most preferred gas is air.

It is to be understood that the foregoing description is merely illustrative and preferred embodiments of the invention of which many variations may be made by those skilled in the art within the scope of the following claims without departing from the spirit thereof.

What is claimed is:

1. A balanced fluid treatment apparatus comprising, in combination, a housing containing an opening and means in said housing to supply fluid to said opening; and an insert for said opening comprising inlet and outlet ducts at the extremities of said insert, connecting means between said inlet and outlet ducts in which the interior of said connecting means forms a passageway between said inlet and outlet ducts and the outer surface of said connecting means contains a circumferential groove form-

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ing a plenum in combination with said housing, and at least one pair of diametrically opposed fluid conduits located in the circumferential groove of said connecting means, said conduits perpendicular to the axis of said passageway between said inlet and outlet ducts, said conduits of sufficient length to run from the surface of said circumferential groove to said passageway in said connecting means.

2. A balanced fluid treatment apparatus comprising, in combination, a housing containing an annular opening and means in said housing to supply fluid to said annular opening; and an insert for said annular opening comprising inlet and outlet ducts at the extremities of said insert, connecting means between said inlet and outlet ducts in which the interior of said connecting means forms a passage between said inlet and outlet ducts and the outer surface of said connecting means contains an annular groove forming a plenum in combination with said housing, and at least one pair of diametrically opposed fluid conduits located in the annular groove of said connecting means, said conduits perpendicular to the axis of said passageway between said inlet and outlet ducts, said conduits of sufficient length to run from the surface of said annular groove to said passageway in said connecting means.

3. The apparatus of claim 2 wherein a pair of diametrically opposed fluid conduits are located in the annular groove of said connecting means.

4. The apparatus of claim 2 wherein the inlet and outlet ducts are concavely conically tapered toward the insert.

5. The apparatus of claim 2 wherein flexible means are attached to said connecting means to maintain said insert firmly in position of said housing.

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6. A self balancing air treatment apparatus comprising in combination an annular opening and a conduit in said housing to supply air to said annular opening; and an insert for said annular opening comprising inlet and outlet ducts at the extremities of said insert, said ducts being concavely conically toward the center of said insert, connecting means between said inlet and outlet ducts in which the interior of said connecting means forms a passageway between said inlet and outlet ducts and the outer surface of said connecting means contains an annular groove forming an air plenum in combination with said housing, a pair of diametrically opposed air conduits located in the annular groove of said connecting means, said conduits perpendicular to the axis of said outlet ducts and of sufficient length to run from the surface of said annular groove to said passageway in said connecting means, a pair of ring receiving grooves on said insert located on opposite sides of said annular groove and flexible O rings on each of said ring receiving grooves to maintain firmly said insert in said housing.

References Cited

UNITED STATES PATENTS

25	3,079,745	3/1963	Breen et al.	57—34
	3,095,343	6/1963	Berger	28—1
	3,110,151	11/1963	Bunting et al.	28—1
30	3,220,082	11/1965	Fletcher et al.	28—1

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